

25. 20° EON 325 mph air speed  
 40° WON 40 mph wind speed  
 +  
 ground speed

$$\hat{r}(t) = \left\langle \frac{1-t^2}{1+t^2}, \frac{2t}{1+t^2} \right\rangle$$

a)  $\hat{v}(t) =$

b) at rest?

c)  $t \rightarrow \infty$   $x \rightarrow ?$   
 $y \rightarrow ?$

Feb 22-9:17 AM

10.3

Polar Graphs

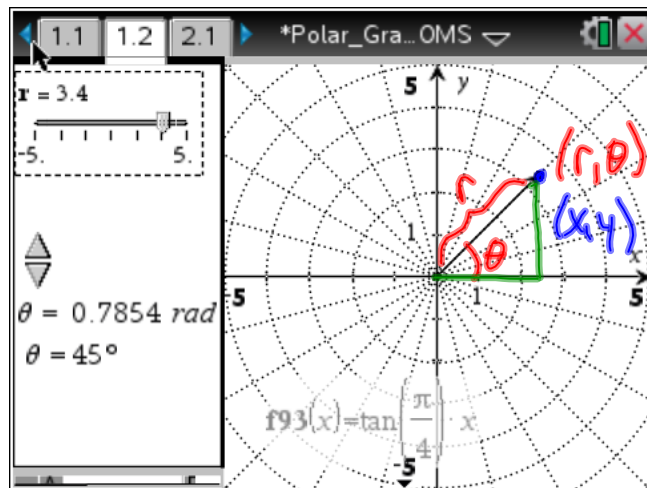
$$x^2 + y^2 = r^2$$

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \tan^{-1} \frac{y}{x}$$

$$x = r \cos \theta$$

$$y = r \sin \theta$$



$$\text{slope} = \frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta}$$

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## Polar Graphs - Rose

What does "n" do?

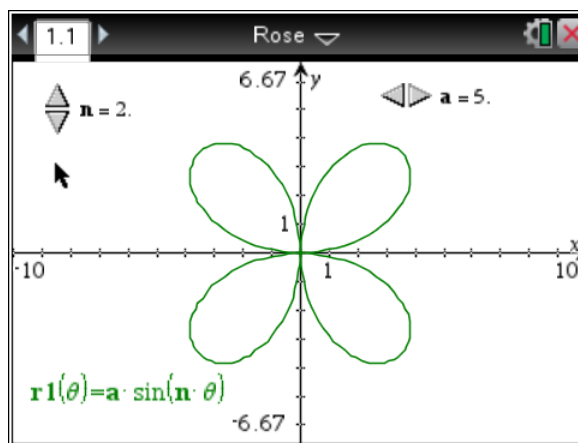
n even, 2n petals

n odd, n petals

what does "a" do

length of petals

cos nθ instead of sin nθ



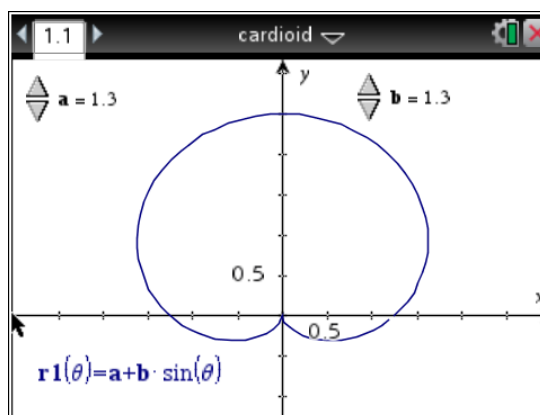
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## Cardioids

$a > b$  limaçon with a dimple

$b > a$  limaçon with a loop

$a = b$  cardioid



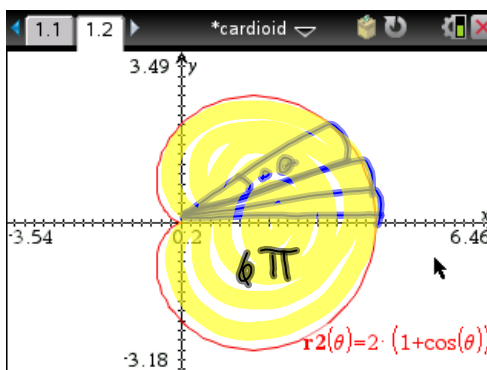
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Area inside polar graphs =  $\int_{\theta_1}^{\theta_2} \frac{1}{2} r^2 d\theta$

Find the area of the region in the plane enclosed by the cardioid

$$r = 2(1 + \cos \theta)$$

$$\int_0^{2\pi} \frac{1}{2} (2(1 + \cos \theta))^2 d\theta$$



$$\Delta A = \frac{1}{2} r^2 \Delta \theta$$

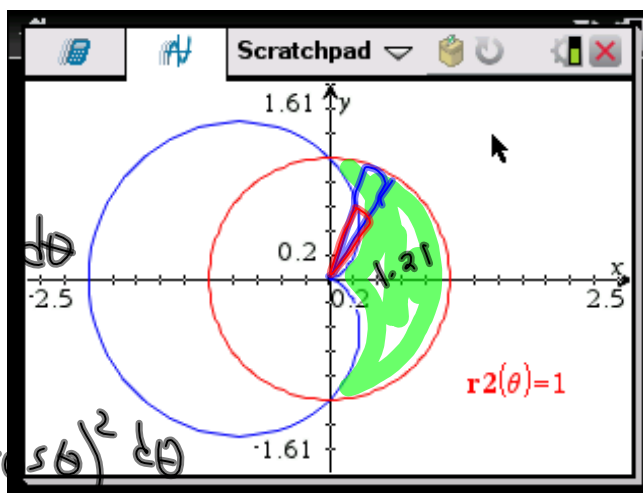
$$\lim_{\Delta \theta \rightarrow 0} \sum \frac{1}{2} r_i^2 \Delta \theta$$

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Find the area of the region that lies inside the circle  $r=1$  and outside the cardioid  $r = 1 - \cos \theta$

$$\int_{-\pi/2}^{\pi/2} \frac{1}{2} 1^2 - \frac{1}{2} (1 - \cos \theta)^2 d\theta$$

$$\int_{-\pi/2}^{\pi/2} \frac{1}{2} 1^2 d\theta - \int_{-\pi/2}^{\pi/2} \frac{1}{2} (1 - \cos \theta)^2 d\theta$$



Feb 21-2:46 PM

Find the slope of the rose curve  $r = 2 \sin (3\theta)$  at the point where  $\theta = \pi/6$  and use it to find the equation of the tangent line. (calc ok)

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